3.3 NEVADA TEST SITE

The Nevada Test Site is located in the southeastern part of Nye County in southern Nevada. The location of NTS within the State of Nevada is illustrated in Figure 2.2.2–1. NTS is operated by a management and integration contractor under the direction of the Nevada Operations Office. It is a remote, secure facility for conducting underground testing of nuclear weapons and evaluating the effects of nuclear weapons on military communications systems, electronics, satellites, sensors, and other materials. The first nuclear test at NTS was conducted in January 1951. Since the signing of the *Threshold Test Ban Treaty* in 1974, it has been the only U.S. site used for nuclear weapons testing.

Approximately one-half of the land (located in the eastern and northwestern portions of the site) is used for nuclear weapons testing, one-quarter (located in the western portion of the site) is reserved for future missions, and one-quarter is used for research and development and other facility requirements. Facilities include nuclear device assembly, diagnostic canister assembly, hazardous liquid spill, and the Radioactive Waste Management Site (RWMS). Figure 2.2.2–2 indicates the location of existing facilities within NTS.

In addition, Yucca Mountain, an area located on the western boundary of the site, is being characterized as directed by the NWPA of 1982, as amended, to determine its suitability as a repository for the disposal of commercial and DOE-owned spent nuclear fuel and radioactive HLW. DOE published an NOI for the preparation of an EIS (August 7, 1995) to evaluate a proposed action to construct, operate, and eventually close a geological repository.

Activities at NTS are concentrated in several general areas. Most of the onsite work is related to defense program activities, although environmental management, other DOE, and non-DOE activities are conducted as well. NTS is a unique facility because it is a large, open area into which access is tightly controlled; it has a substantial infrastructure; and it has the capability to handle and run tests using hazardous or radioactive materials. Because of this, activities other than nuclear testing, including mobile missile transporter tests and nuclear rocket tests, have been carried out for other Federal departments and agencies.

Department of Energy Activities. The NTS was established as the site within the United States where underground testing of nuclear weapons would occur. Since that time, other missions have been added due to the nature of the site. Likewise some activities have been terminated or not actively pursued. The current missions at NTS are shown in Table 3.3–1.

Table 3.3–1. Current Missions at Nevada Test Site

Mission	Description	Sponsor
Defense	Stockpile stewardship, including the maintenance of readiness to conduct an underground nuclear test, if directed	Assistant Secretary for Defense Programs
Waste management	Safe and permanent disposal of waste through either disposal on the NTS or to offsite commercial waste treatment or disposal facilities	Assistant Secretary for Environmental Management
Environmental restoration	Identify contaminated areas and cleanup those areas, as appropriate	Assistant Secretary for Environmental Management
Nondefense research & development	Original research efforts by the DOE, universities, industry, and other federal agencies	Various Federal Departments and Agencies
Work for others	Use of NTS areas and facilities by other groups and agencies for activities such as military training exercises	Various Federal Departments and Agencies

Source: DOE 1995i.

In addition to DOE nuclear testing activities at NTS, the Defense Special Weapons Agency has conducted tests that provide DoD with data regarding vulnerability and survivability of nuclear and nonnuclear weapons systems produced by the United States. DOE defense activities at NTS are closely related to Defense Special Weapons Agency activities, with both contributing to national security. The moratorium on U.S. nuclear testing began in October 1992 in accordance with the Hatfield Amendment. At the same time, however, the President required that NTS retain the capability to resume testing if authorized. Before the moratorium, nuclear testing was limited to those tests that supported the safety and reliability of the Nation's nuclear stockpile. [Text deleted.] In July 1993, the President extended the moratorium on nuclear tests (both DOE and DoD) indefinitely, but continued to require testing capabilities at NTS.

A facility for DOE activities, the 9,300 m^2 (100,000 ft^2) DAF, is located south of Control Point One in Area 6. Both LANL and LLNL can use this facility for conducting multiple operations with high explosives and nuclear devices simultaneously. Because of its multiple facilities areas that include assembly cells, assembly bays, high bays, radiographic facilities, special nuclear materials laboratories, high explosive (HE) storage, special nuclear material storage, shipping and receiving areas, and associated administrative and support areas, all aspects of nuclear device preparations could be handled in this one facility. In addition, the facility could provide increased overall security and allow easier entrance and exit accessibility for the workers during hazardous operations. There would be no manufacturing of special nuclear material at this facility.

There are active radioactive and mixed waste disposal areas onsite in Areas 3 and 5. The only major environmental management facility anticipated for NTS is a waste management facility to handle TRU wastes. A major program to characterize the groundwater at NTS is in progress to determine regional flow paths and rates and to detect any migration of contamination from past nuclear testing.

Although the principal activity at NTS has been the underground testing of nuclear devices, DOE is also involved in a number of other activities, including:

- The Yucca Mountain site in southern Nevada is being evaluated for its suitability as a repository to dispose of commercial and DOE-owned spent nuclear fuel and HLW. The Yucca Mountain Site Characterization Office (YMSCO) is conducting the site characterization activities and reports directly to Office of Civilian Radioactive Waste Management. However, because Yucca Mountain is collocated with NTS, the DOE Nevada Operations Office provides some administrative support services to YMSCO.

- The Spill Test Facility in Area 5 was completed in 1986. It is operated on a fee basis for commercial users as a basic research tool to study the dynamics of accidental releases of hazardous materials and to evaluate the effectiveness of various foams and fire retardants in accidents involving chemicals and hazardous materials.

Non-Department of Energy Activities. The main non-DOE activity at NTS was the Defense Special Weapons Agency's use of the site as a nuclear weapons effects testing facility in Area 12. Weapons effects tests were conducted to study a number of nuclear effects, including x-rays, gamma rays, neutrons, electromagnetic pulse, air blast, ground and water shock, propagation, and temperature. These tests assessed military systems in a nuclear environment. These tests were carried out in underground tunnels, including the P-Tunnel which is being considered for long-term storage alternatives in this PEIS. Various other military exercises and training activities are currently carried out at NTS.

3.3.1 LAND RESOURCES

Land Use. The NTS occupies approximately 350,000 ha (approximately 864,000 acres) (NT DOE 1996c:4-1; NT DOE 1994d:2) in southern Nye County of southern Nevada, with the southwestern boundary located approximately 16 km (10 mi) from California. The town of Indian Springs and Indian Springs Air Force Auxiliary Field in northeast Clark County, Nevada, are located 39 km (24.2 mi) southeast of the NTS boundary. All of the land within NTS is owned by the Federal Government and is administered, managed, and controlled by DOE. NTS is entirely bordered by Federal land—to the north, east, and west by Nellis Air Force Range, and to the south by land administered by the BLM.

In the mid-1800s, lands that now comprise NTS were included within the boundary of the Ruby Valley Treaty between the United States and the Western Bands of the Shoshone Indians. In 1951, the Shoshone tribe sought compensation for the loss of aboriginal title to these lands and was later awarded $26 million (NT DOE 1995e:2). The land area that today constitutes the current NTS configuration was withdrawn from all forms of appropriation under the public land laws, including mining and mineral-leasing laws through four Public Land Orders and a Memorandum of Understanding with the U.S. Air Force (NT DOE 1996c:4-5, 4-8, 4-9). The NTS boundary is defined by the four land withdrawals (NT DOE 1996f:2). On February 12, 1952, Public Land Order 805 reserved approximately 176,040 ha (435,00 acres) of land for use by the Atomic Energy Commission (AEC) as a weapons testing site. Approximately 15,540 ha (38,400 acres) were reserved for the use of the AEC in connection with NTS under Public Land Order 1662 on June 20, 1958. The lands described under this Public Land Order are not considered for any storage and disposition alternative and therefore are not addressed in this PEIS (NT DOE 1996c:4-5).

On December 19, 1961, approximately 128,691 ha (318,000 acres) of land previously reserved for use by the U.S. Air Force were transferred to the jurisdiction of the AEC for use in connection with NTS for test facilities, roads, utilities, and safety distances under Public Land Order 2568. Approximately 8,542 ha (21,108 acres) of land were reserved for the jurisdiction of the AEC for use in connection with NTS on August 3, 1965 under Public Land Order 3759. The northern portions of Areas 19 and 20, which encompass approximately 42,994 ha (106,240 acres), is managed by DOE as part of NTS in accordance with a 1963 Memorandum of Understanding with the U.S. Air Force. This memorandum was superseded by a Memorandum of Understanding between the U.S. Air Force and DOE/NV in 1982 (NT DOE 1996c:4-5). Therefore, the NTS site boundary does not include Pahute Mesa (NT DOE 1996f:2).

Existing Land Use. Generalized land uses at NTS and its vicinity are shown in Figure 3.3.1–1. NTS is divided into three major regions (Figure 3.3.1–2). The northern and eastern regions of NTS constitute the underground nuclear weapons test area. Nuclear test ranges are located at Yucca Flat, Pahute Mesa, Rainier Mesa, and Buckboard Mesa. The southwestern region of NTS (Area 25) provides support for nonweapons and nonnuclear weapons programs, such as the site characterization studies at Yucca Mountain, and for short-term activities, such as the Nuclear Weapons Accident Exercises conducted by the Nuclear Emergency Search Team. The remaining region contains the nonnuclear explosives test area and primary administrative and support area of NTS. NTS is subdivided into numbered areas, many of which are used or reserved for specific purposes.

In 1992, DOE designated all of NTS as a NERP. The NERP is used by the national scientific community as an outdoor laboratory for research on the effects of human activities on the desert ecosystem (DOE 1994u:v,31). There is no prime farmland present within NTS. Past agricultural activities were limited to an EPA agricultural and animal radiological research facility that closed in 1981. Offsite agricultural activity occurs on the south side of U.S. Route 95 and is limited to a cattle allotment granted by the BLM.

The Timber Mountain Caldera National Natural Landmark is located in the northwest portion of NTS. It is separated from much of NTS by mountains along its eastern border. A recommendation to include approximately 539,000 ha (1,333,000 acres) of the Desert National Wildlife Range (DNWR), which is managed by the USFWS, in the National Wilderness Preservation System has been tabled (NV FWS 1994a:3-5,3-6). This

area of the DNWR is also part of the Nellis Air Force Range; it is jointly managed by the U.S. Air Force and USFWS. Public entry to this part of the wildlife range is generally prohibited by the Air Force, however, public entry that is allowed onto the DNWR does not occur in areas with views of NTS (NTS 1995a:6). The closest residence is located 2 km (1.3 mi) south of the NTS boundary, in the unincorporated town of Amargosa Valley.

Land-Use Planning. The Department has prepared a sitewide EIS for NTS that analyzes the environmental impacts associated with managing NTS and its resources. Four alternatives, including No Action, are presented in the EIS, with land-use and zoning categories described for each alternative. Land-use planning does not occur at the State level in Nevada; however, counties and other municipalities may plan if they so choose. The recently adopted Nye County comprehensive plan is a policy document that permits Nye County to begin a process of establishing a comprehensive land-use plan and zoning ordinance. No municipalities within Nye County have adopted land-use plans, policies, or controls (NT County 1995a:1).

Visual Resources. The NTS is located in a transition area between the Mojave Desert and the Great Basin. Vegetation characteristic of both deserts are found on NTS. The topography of NTS consists of a series of north-south oriented mountain ranges separated by broad, low-lying valleys and flats. Site topography is also characterized by the presence of numerous subsidence craters resulting from past nuclear testing. The southwestern Nevada volcanic field, which includes portions of NTS, is a nested, multicaldera volcanic field. The facilities of NTS are widely distributed across this desert setting.

The area surrounding NTS is unpopulated to sparsely populated desert and rural lands. Access to areas that would have views of NTS is controlled by NTS or the U.S. Air Force; therefore, there are few viewpoints accessible to the general public. Public viewpoints of NTS along U.S. Route 95, the principal highway between Tonopah and Las Vegas, are limited to Mercury Valley due to the various mountain ranges surrounding the NTS southern boundary. The primary viewpoint in the Mercury Valley is a roadside turnoff containing Nevada Historical Marker No. 165 of the Nevada State Park System, entitled "Nevada Test Site." The NTS facilities within 8 km (5 mi) are visible from this viewpoint. The main base camp at Mercury, located in Area 23, is well defined at night by facility lighting. The developed areas of NTS are consistent with a BLM VRM Class 5 designation. Other areas range from Class 2 to Class 4.

3.3.2 SITE INFRASTRUCTURE

Baseline Characteristics. Activities at NTS are concentrated at facilities in several general areas. Section 3.3 describes current NTS missions. To support these missions, an extensive infrastructure exists, as shown in Table 3.3.2–1.

Table 3.3.2–1. Nevada Test Site Baseline Characteristics

Characteristics	Current Usage	Site Availability
Transportation		
Roads (km)	640	1,100[a]
Railroads (km)	0	0
Electrical		
Energy consumption (MWh/yr)	121,460	176,844
Peak load (MWe)	27	45
Fuel		
Natural gas (m^3/yr)	0	0
Oil (l/yr)	5,716,000	5,716,000
Coal (t/yr)	0	0
Steam (kg/hr)	0	0

[a] Includes paved and unpaved roads.
Source: NTS 1993a:4.

The onsite transportation capability at NTS provides for safe and secure movement of nuclear materials. Movements are made via truck to and around the site. Improved and unimproved roads cover most of the NTS. Railbeds have existed in both Areas 25 and 26 for experimental purposes. These railbeds are neither maintained nor connected. Currently, there is no operating rail on NTS.

The regional electric power pool in which NTS is located, and from which it draws power, is the California-Southern Nevada Power Area. Electricity is provided by two independent 138-kilovolt (kV) lines. The capacity of the system is approximately 45 MWe. The site is near a major electrical hub that ties into several other areas.

Coal, nuclear, hydroelectric and geothermal, and oil and gas all contribute significantly to the region's electrical power system. Generating capacity margin for the regional pool is at 21 percent of current peak demand (see Table 3.3.2–2).

The NTS water supply system consists of 13 supply wells, pumps, booster pumps, and many sumps, reservoirs, chlorinator water softeners, and 160 km (100 mi) of supply lines. This water system is capable of producing 284 million l/week (75 million gal/week).

A major facility that could be used to store materials within the scope of this PEIS is the P-Tunnel complex located in Area 12 in the northern portion of NTS. This facility is a 1,000 m (3,281 ft) tunnel with multiple side drifts and an average earth cover of approximately 260 m (853 ft). The tunnel and drifts vary in dimension, but most are larger than 4 m (13 ft) in diameter and are lined with shotcrete. The Defense Special Weapons Agency used the P-Tunnel to perform underground nuclear effects tests.

Table 3.3.2–2. California–Southern Nevada Sub-Regional Power Pool Electrical Summary

Characteristics	Energy Production
Type Fuel	
Coal	14%
Nuclear	15%
Hydro/geothermal	19%
Oil/gas	22%
Other[a]	30%
Total Annual Production	246,012,000 MWh
Total Annual Load	293,262,000 MWh
Energy Imported Annually[b]	45,400,000 MWh
Generating Capacity	61,681 MWe
Peak Demand	57,028 MWe
Capacity Margin[c]	11,809 MWe

[a] Includes power from both utility and nonutility sources.

[b] Energy imported is not the difference of production and load due to positive net pumped storage.

[c] Capacity margin is the amount of generating capacity available to provide for scheduled maintenance, emergency outages, system operating requirements, and unforeseen electrical demand.

Source: NERC 1993a.

3.3.3 AIR QUALITY AND NOISE

Meteorology and Climatology. The climate at NTS and in the surrounding region is characterized by limited precipitation, low humidity, and large diurnal temperature ranges. The lower elevations are characterized by hot summers and mild winters, which are typical of other Great Basin desert areas. As elevation increases, precipitation increases and temperatures decrease (NT DOE 1986b:3-46).

The average annual temperature at NTS is 19.5 °C (67.1 °F); temperatures range from an average daily minimum of 0.9 °C (33.6 °F) in January to an average daily maximum of 41.1 °C (105.9 °F) in July. The average annual precipitation at NTS is 10.5 cm (4.13 in). Prevailing winds at NTS vary by location. The average annual windspeed is 4.2 m/s (9.4 mph) (NOAA 1994d:3). Additional information related to meteorology and climatology at NTS is presented in Appendix F.

Ambient Air Quality. The NTS is located within the Nevada AQCR (#147). The region is designated as an attainment area (40 CFR 81.329) with respect to NAAQS for criteria pollutants. Applicable NAAQS and Nevada State ambient air quality standards are presented in Appendix F.

Two PSD (40 CFR 52.21) Class I areas in the vicinity of NTS are Grand Canyon National Park, approximately 193 km (120 mi) southeast of the site, and Sequoia National Park, California, approximately 169 km (105 mi) west-southwest of the site. Since the creation of the PSD program in 1977, no PSD permits have been required for any emissions source at NTS.

The primary emission sources of criteria air pollutants at NTS include particulates from construction and other surface disturbances, fugitive dust from unpaved roads, various pollutants from fuel-burning equipment, incineration, open burning, and volatile organic chemicals (VOCs) from fuel storage facilities. A summary of emission estimates for sources at NTS is presented in Appendix F.

Table 3.3.3–1 shows the site baseline ambient air concentrations for criteria pollutants and other pollutants of concern at NTS. No hazardous air pollutants or other toxic compound sources are indicated. Baseline concentrations are in compliance with applicable guidelines and regulations. Elevated levels of O_3 and PM_{10} may occur occasionally because of pollutants transported into the area by wind or because of local sources of fugitive particulates. Concentrations of other criteria pollutants are low because there are no large emission sources nearby. The nearest nonattainment area is the Las Vegas area (40 CFR 81.329), located approximately 105 km (65 mi) southeast of NTS.

Noise. Major noise emission sources within NTS include various industrial facilities, equipment and machines (for example, cooling systems, transformers, engines, pumps, boilers, steam vents, paging systems, construction and materials handling equipment, and vehicles), and aircraft operations. No known noise surveys have been conducted at NTS to determine background sound levels. Most industrial facilities at NTS are at sufficient distance from the site boundary that noise levels at the boundary from these sources would not be measurable or would be barely distinguishable from background noise levels.

The acoustic environment around NTS is primarily uninhabited desert and small rural communities. In the uninhabited desert, the major sources of noise are natural physical phenomena, such as wind, rain, and wildlife activities, and an occasional airplane. The wind is the predominant noise source. Desert noise levels as a function of wind have been measured at an upper limit of 22 dBA for a still desert and 38 dBA for a windy desert (Webb 1983a:170). A background sound level of 30 dBA is probably a reasonable estimate. This agrees with other estimates of sound levels for rural areas. Annual rural-community day and night average sound levels (DNL) have been estimated in the range of 35 to 50 dBA and are considered to be a reasonable estimate for Indian Springs, Mercury, and the town of Amargosa Valley (EPA 1974a:B-4). Except for the prohibition of nuisance noise, neither the State of Nevada nor its local governments have established specific numerical environmental noise standards applicable to NTS.

Table 3.3.3–1. Comparison of Baseline Ambient Air Concentrations With Most Stringent Applicable Regulations or Guidelines at Nevada Test Site, 1990-1992

Pollutant	Averaging Time	Most Stringent Regulation or Guideline[a] ($\mu g/m^3$)	Baseline Concentration[b] ($\mu g/m^3$)
Criteria Pollutants			
Carbon monoxide	8-hour	10,000[c]	2,290
	1-hour	40,000[c]	2,748
Lead	Calendar Quarter	1.5[c]	[d]
Nitrogen dioxide	Annual	100[c]	[d]
Ozone	1-hour	235[c]	[e]
Particulate matter less than or equal to 10 microns in diameter	Annual	50[c]	9.4
	24-hour	150[c]	106
Sulfur dioxide	Annual	80[c]	8.4
	24-hour	365[c]	94.6
	3-hour	1,300[c]	725
Mandated by the State of Nevada			
Hydrogen sulfide	1-hour	112[f]	[d]

[a] The more stringent of the Federal and State standards is presented if both exist for the averaging time.

[b] Modeled concentration based on permit data except for CO which are monitored values.

[c] Federal and State standard.

[d] No sources of this pollutant have been identified.

[e] Ozone, as a criteria pollutant, is not directly emitted or monitored by the site. See Section 4.1.3 for a discussion of ozone-related issues.

[f] State standard.

Source: 40 CFR 50; NT REECO 1990a; NV DCNR 1992a; NV DCNR 1995a.

3.3.4 WATER RESOURCES

Surface Water. There are no continuously flowing streams on NTS. The most noticeable natural hydrologic features of NTS are the playas (lake beds) that collect stormwater runoff. Runoff in the eastern half of the site ultimately collects in the playas of Yucca Flat and Frenchman Flat. In the northeastern portion, runoff drains outside the test site and onto the Nellis Air Force Range Complex. In the western half and southernmost portion, runoff is carried offsite towards the Amargosa Desert. Figure 3.3.4–1 shows the location of the playas and flats. A few natural springs can be found at NTS. Surface water is not used at NTS.

There have been no studies conducted to assess 500-year floodplain boundaries at NTS. Two 100-year flood analyses have been conducted; these analyses show no runoff from a 100-year storm affecting the proposed project areas. One analysis was for Jackass Flats, but it is not near the proposed project areas. The 100-year floodplain study has been completed for the radioactive waste management site located in Area 5. This showed water flowed to the Frenchman Lake region of Area 5. However, the proposed project areas are in a region where flash flooding occurs due to locally isolated intense convection storms. These floods normally last less than 6 hours (NT DOE 1992d:4-27).

Surface Water Quality. There are no NPDES permits for the site as there are no wastewater discharges to onsite or offsite surface waters. However, the State has issued sewage discharge permits for sewage lagoons and ponds for NTS facilities. Because there are no surface waters at or near the proposed project area, and because there will be no withdrawal or discharge to natural surface waters at NTS, the assessment of surface water quality is not applicable.

Surface Water Rights and Permits. Surface water rights are not an issue because NTS facilities do not withdraw surface water for use nor do they discharge effluents directly to natural surface waters.

Groundwater. The NTS is located within three groundwater subbasins of the Death Valley Groundwater Basin. Groundwater beneath the eastern portion of NTS is located in the Ash Meadows Subbasin; the western portion is located in the Alkali Flat Furnace Creek Ranch Subbasin; and a small part of the northwestern corner is located in the Oasis Valley Subbasin (Figure 3.3.4–2). The actual subbasin boundaries, however, are poorly defined. Three general aquifers are present at NTS: the Lower Carbonate (the deepest), the Volcanic, and the Valley-Fill (the shallowest) (NT DOE 1992d:4-14). Other aquifers are present to a limited extent under the area, but their water-bearing potential has not been thoroughly investigated. Limited aquifers may occur in other volcanic units, including lava flows and bedded tuffs.

The Lower Carbonate is the regional aquifer and is comprised of carbonate rocks of Middle Cambrian through Devonian age. The saturated thickness of this confined aquifer ranges from approximately 100 m to over 1,000 m (328 ft to over 3,280 ft). This aquifer drains in a south-southwest direction, under Yucca and Frenchman Flats, toward Ash Meadows (NT DOE 1992d:4-14). However, due to the large topographic changes across the area and the importance of fractures to groundwater flow in this aquifer, local flow directions can vary significantly from this regional trend. The unconfined Volcanic and Valley-Fill aquifers range in thickness from close to 0 to about 610 m (2,000 ft) and occur in the Frenchman and Yucca Flats drainage basins, respectively (NT DOE 1992d:4-17).

Depth to groundwater at NTS ranges from approximately 150 m to over 700 m (492 ft to over 2,300 ft). It is approximately 490 m (1,607 ft) at Yucca Flat, 250 m (820 ft) at Frenchman Flat, and over 700 m (2,300 ft) at Pahute Mesa. However, there are areas of perched water that lie at considerably shallower depths.

Recent estimates of the perennial yield of all NTS aquifers (that is, the total amount that can be removed on an annual basis without resulting in a net depleting of the groundwater reservoir) range from 57 billion l (15 billion gal) (NT USGS 1988a) to 38 billion l (10 billion gal) (NT DOE 1992b:41-43). Groundwater is recharged from infiltration of precipitation in the northern and eastern mountain ranges and from underflow from upgradient

areas. Natural discharge from the aquifers primarily occurs from evaporation and transpiration in the Amargosa Valley (including Ash Meadows) and Death Valley areas (Figure 3.3.4–2).

Devils Hole is a water-filled limestone cavern near Ash Meadows, approximately 48 km (29.8 mi) southwest of the NTS southern boundary, and is known to contain the endangered Devils Hole pupfish. Groundwater pumping at Ash Meadows was curtailed by order of the U.S. Supreme Court in order to protect the endangered Devils Hole pupfish by maintaining water levels at Devils Hole. Studies have shown, however, that historical pumping at NTS at rates that exceed current rates was probably unrelated to observed declines at Devils Hole (NT DOE 1993b:4-27).

Groundwater Quality. Currently, aquifers beneath NTS have not been classified by EPA. However, during an independent study (NT DOE 1989a:11), the aquifers beneath NTS were classified as Class IIa and Class IIb (groundwater currently used for drinking water). In 1972, the DOE Nevada Operations Office instituted a Long-Term Hydrological Monitoring Program to be operated by the EPA under an Interagency Agreement. Groundwater is monitored on and around NTS, and at two off-NTS sites in Nevada. Only wells drilled previously for water supply or exploratory purposes are being used in the monitoring program. In compliance with the SDWA and a State of Nevada drinking water supply system permit, drinking water wells and industrial use distribution systems are sampled and analyzed on a monthly basis. Groundwater samples collected are analyzed for a standard suite of parameters and constituents, including radioactive materials, nonradioactive materials, hydrogen-ion concentration (pH), total dissolved solids (TDS) and other field parameters.

Groundwater under portions of NTS has been affected as a result of nuclear testing activities conducted during the last 43 years. Additionally, 20 percent of the tests have been conducted below the water table or have been close enough that effects have extended below it. Table 3.3.4–1 shows the groundwater quality at NTS.

Table 3.3.4–1. Groundwater Quality Monitoring at Nevada Test Site, 1993

Parameter	Unit of Measure	Water Quality Criteria and Standards[a]	Potable Water Distribution System	
			High	Low
Alkalinity	mg/l	NA	270	64
Alpha (gross)	pCi/l	15[b]	11	0.62
Arsenic	mg/l	0.05[b]	0.012	<0.003[c]
Barium	mg/l	2.0[b]	0.15	0.00
Beta (gross)	pCi/l	50[d]	13	3.2
Chromium	mg/l	0.1[b]	<0.005[c]	<0.005[c]
Lead	mg/l	0.015[b]	<0.005[c]	<0.005[c]
Nitrate	mg/l	10[b]	6.8	1.2
pH	pH units	6.5-8.5[e]	8.66	7.70
Sodium	mg/l	NA	103	30
Total dissolved solids	mg/l	500[e]	639	283
Tritium	pCi/l	80,000[f]	120	0.93

[a] For comparison purposes only.

[b] National Primary Drinking Water Regulations (40 CFR 141).

[c] Below detection limit.

[d] Proposed National Primary Drinking Water Regulations; Radionuclides (56 FR 33050).

[e] National Secondary Drinking Water Regulations (40 CFR 143).

[f] DOE DCG for water (DOE Order 5400.5). DCG values are based on a committed effective dose of 100 mrem per year. However, because the drinking water maximum contaminant level is based on 4 mrem per year, the number listed is 4 percent of the DCG.

Note: NA=not applicable.

Source: NT DOE 1994b.

Due to the past nuclear testing activities at NTS, radionuclide monitoring has been an important component of the groundwater monitoring program at the site. In general, tritium is the only radionuclide that appears in sampled water. Samples collected in 1993 show tritium concentrations ranging from 120 pCi/l (454 pCi/gal), in a non-potable supply well located in the northwestern part of NTS, to 0.93 pCi/l (3.5 pCi/gal), in a potable supply well located in the southeastern part of NTS. Subsurface migration of tritium to offsite areas is possible, but the probability of tritium reaching offsite wells or springs is minimal. It is also thought that the Lower and Upper Carbonate aquifers would most likely be the aquifers in which tritium might migrate to offsite areas.

Groundwater Availability, Use, and Rights. Groundwater is the only local source of industrial and drinking water supply in the NTS area. Numerous production wells are located on NTS and distributed among various areas of the site. Figure 3.3.4–2 shows how the NTS water system has been divided into four water service areas (A, B, C, and D) based on the location of the water supply system and support facilities. Water usage on NTS is largely for potable, construction, and dust control purposes. Water supply wells at NTS draw water from the Lower and Upper Carbonate, the Volcanic, and the Valley-Fill aquifers. The total water usage in 1994 was 2,400 million l/yr (634 million gal/yr), of which 1.3 million l/yr (343.3 million gal/yr) were withdrawn from the Ash Meadows Subbasin, and 1,100 million l/yr (290.5 million gal/yr) were withdrawn from the Alkali Flat Furnace Creek Ranch Subbasin (Figure 3.3.4–2). The pumping capacity for all the water supply wells at NTS is estimated at 14,800 million l/yr (3,900 million gal/yr) (NTS 1993a:6).

The State of Nevada strictly controls all surface and groundwater withdrawals. The Appropriation Doctrine governs the acquisition and use of water rights. However, it is an established principle that when land is withdrawn from public use and reserved for Federal purposes, the Government's right to associated water may be implied. NTS has been withdrawn from public use and thus possesses an unqualified water right sufficient to meet the purposes of the NTS land withdrawal, subject to water rights that existed at the time the land for NTS was withdrawn.

Since the Federal Government has not waived its sovereign immunity with respect to Nevada's well drilling laws, it is not subject to these requirements. While DOE Nevada Operation Office is not legally required to follow Nevada water appropriation and well drilling requirements, there is no objection to responding to requests for information and cooperating in other respects with the Nevada Division of Water Resources as a gesture of goodwill.

3.3.5 GEOLOGY AND SOILS

Geology. The NTS is located in the southern part of the Great Basin section of the Basin and Range physiographic province in an intermediate position between the high, topographically closed basins in central Nevada and the low, connected basins of the Amargosa Desert-Death Valley region to the southwest. NTS consists of three flats (Yucca, Jackass, and Frenchman) surrounded by mountains. Local geology is characterized by mountains of Precambrian and Paleozoic sedimentary rocks and Tertiary volcanic tuffs and lavas. Sedimentary rocks are complex, folded, and faulted carbonates in the upper and lower parts and shale and sandstone in the middle section. Volcanic rocks are predominantly Tertiary tuffs with some basalts and scattered granitic plutons. Potential geologic resources within the NTS boundaries include silver, gold, tungsten, molybdenum, zeolites, barite, and fluorite.

The general region has been tectonically active in the recent past and has numerous faults. NTS lies in an area of moderate historic seismic activity on the southern margin of the southern Nevada, East-West Seismic Belt in Seismic Zones 2 and 3, indicating that moderate-to-major damage could occur as a result of an earthquake (Figure 3.3.5–1). More than 4,000 earthquakes have been recorded within a 241-km (150-mi) radius of NTS. Most of these were minor events, with Richter magnitudes of less than 5.5 and MMIs that may correlate to maximum ground acceleration of 0.03 gravity (Figure 3.3.5–1). The largest seismic event on record took place 161 km (100 mi) west in Owens Valley, California, and had an estimated Richter magnitude of 8.3 (NT DOE 1988a:3-117). On June 29, 1992, an earthquake of magnitude 5.6 occurred in the southwest corner of the site under Little Skull Mountain (Figure 3.3.5–1). The maximum ground acceleration from this earthquake was approximately 0.21 g at Amargosa Valley.

The Yucca and Carpetbag Faults were active during the Late Quaternary, and both are considered to be capable faults by the definition outlined in 10 CFR 100, Appendix A. The Yucca Fault has undergone surface rupture within the past few thousand to tens-of-thousands of years. Some earthquakes can be directly associated with the fault trace and also beyond the south end of the mapped section in the Yucca Pass, suggesting that the fault may continue in that direction. No significant vertical surface displacement has occurred on the Carpetbag Fault system during the past 150,000 years, but there is evidence of episodes of fracturing and possible minor faulting from 30,000 to 240,000 years ago, with average recurrence interval of about 25,000 years for the last 125,000 years. The Carpetbag Fault has been mapped in the subsurface beyond the southern end of Yucca Basin and may project to the northeast. Possible magnitude, intensity, and acceleration of earthquakes along the Yucca and Carpetbag Faults have not been estimated.

The Cane Spring Fault does not show Holocene displacement but is thought to have been the source of a 4.3 Richter magnitude earthquake in 1971. The maximum credible earthquake associated with the Cane Spring Fault is expected to produce a peak acceleration of 0.67 g with a 6.7 Richter magnitude. The recurrence interval is estimated to be 10,000 to 30,000 years. The Cane Spring Fault extends to the southwest and is connected in the deep subsurface to a third capable fault, the Rock Valley Fault, which has been the epicenter for several earthquakes of Richter magnitudes between 3 and 4 since 1992.

The most recent volcanic activity in the immediate area was 0.3 million years ago, and the likelihood for renewed activity in the next 10,000 years is slight (NT LANL 1983a:7). NTS lies approximately 241 km (150 mi) southeast of the Long Valley area of California, an area of potential volcanic eruption of the Mount St. Helens type.

Soils. Soils at NTS include three major types: shallow soils developed in the uplands and mountains; soils on valley fill and nearly-level-to-moderately sloping outwash plains, alluvial fans, and fan aprons; and playas and soils on nearly level flats and basins. Possible erosion hazards range from slight to severe while the shrink-swell potential ranges from low to high for some of these soils. The potential for wind erosion and shrink-swell increases in the playas and basins. The potential for water erosion increases with increasing slope. The soils at NTS are considered acceptable for standard construction techniques.

3.3.6 BIOLOGICAL RESOURCES

Terrestrial Resources. The NTS lies in a transition area between the Mojave and Great Basin Deserts. As a result, flora and fauna that are characteristic of both deserts are found within the site boundaries (NT ERDA 1976a:34). Approximately 33 km^2 (12.7 mi^2) of NTS have been developed, which represents about 1 percent of the site; thus, natural plant communities are found across most of NTS (NT DOE 1988d:3,4,6,7). The site has been divided into nine major plant communities, as shown in Figure 3.3.6–1.

Of the plant communities present onsite, the mountains, hills and mesas, sagebrush, creosote bush, and hopsage-desert thorn communities are the most extensive. Saltbush and desert thorn communities occupy more limited areas adjacent to the playas in Frenchman and Yucca Flats. Introduced plants such as red brome, cheatgrass, and Russian thistle have become important species in some areas. These plants rapidly invade disturbed areas and delay revegetation by native species (NT Hunter 1991a:1 of abstract). A total of 711 taxa of vascular plants have been identified on or near NTS (NT ERDA 1976a:34).

Terrestrial wildlife found on NTS includes 33 species of reptiles, 222 species of birds, and 49 species of mammals (NT Greger 1992a; NTS 1990a:1; NTS 1990a:2). Species common to NTS include the side-blotched lizard, western shovel-nosed snake, black-throated sparrow, red-tailed hawk, Merriam's kangaroo rat, and Great Basin pocket mouse. Water holes, both natural and manmade, are important to many species of wildlife, including game animals such as pronghorn and mule deer (NT Greger nda). Hunting is not permitted anywhere on NTS. Raptors such as the turkey vulture and rough-legged hawk, and carnivores such as the long-tailed weasel and bobcat, are two ecologically important groups on NTS. A variety of migratory birds has been found at NTS. Migratory birds, as well as their nests and eggs, are protected by the *Migratory Bird Treaty Act*. Eagles are similarly protected by the *Bald and Golden Eagle Protection Act*.

Vegetative cover in the area of Frenchman Flat proposed for the consolidated Pu storage facility (which is also the assumed analysis site for a number of disposition alternatives) falls primarily within the creosote bush community (Figure 3.3.6–1). Fauna found in this area would be expected to be closely associated with Mojave desert fauna, and species could include the banded gecko, desert iguana, Gambel's quail, greater roadrunner, round-tailed ground squirrel, and cactus mouse. Vegetation within the alternative consolidated Pu storage facility site (P-Tunnel location) falls within the mountains, hills, and mesas and blackbrush communities. Fauna found in this more northerly location would be most closely associated with Great Basin desert fauna. Animal species present could include the sagebrush lizard, western skink, Great Basin pocket mouse, and Great Basin kangaroo rat (NT ERDA 1976a:47,48,56).

Wetlands. The NWI maps of NTS have not been prepared nor have wetlands been delineated on the site. However, small wetland areas (less than 0.4 ha [1 acre]) may be associated with NTS springs (NTS 1992a:5). There are no known wetlands in either of the proposed storage facility sites.

Aquatic Resources. Potential aquatic habitat on NTS includes surface drainages, playas, springs, and manmade reservoirs. There are no continuously flowing streams on the site and permanent surface water sources are limited to a few small springs. These surface drainages, playas, and springs are unable to support permanent fish populations (DOE 1995w:2.4-61,2.4-62). Manmade water reservoirs located throughout the site support three introduced species of fish: bluegill, goldfish, and golden shiners (NTS 1992a:6). There are no known aquatic resources in either of the proposed storage facility sites.

Threatened and Endangered Species. There are nine federally and State-listed threatened, endangered, and other special status species found in the vicinity of NTS. Eight of these are federally or State-listed as threatened or endangered or protected under State law (Table 3.3.6–1). Eight species listed in Table 3.3.6–1 have been observed on NTS. Once specific project locations have been determined, site surveys will verify the presence of special status species. No critical habitat for threatened or endangered species, as defined in the ESA (50 CFR 17.11; 50 CFR 17.12), exists on NTS.

Table 3.3.6–1. Federally and State-Listed Threatened, Endangered, and Other Special Status Species That May Be Found on or in the Vicinity of Nevada Test Site

Common Name	Scientific Name	Status[a]	
		Federal	State
Mammal			
[Text deleted.]			
Spotted bat[b]	*Euderma maculatum*	NL	T
[Text deleted.]			
Birds			
American peregrine falcon[c,d]	*Falco peregrinus anatum*	E	T
Arctic peregrine falcon[c]	*Falco peregrinus tundrius*	E(S/A)	T
Bald eagle[b,d]	*Haliaeetus leucocephalus*	T	T
[Text deleted.]			
Mountain plover[b]	*Charadrius montanus*	C	NL
[Text deleted.]			
Reptiles			
[Text deleted.]			
Desert tortoise [b,e]	*Gopherus agassizii*	T	T
Fish			
Devils Hole pupfish[d,f]	*Cyprinodon diabolis*	E	E
Plants			
[Text deleted.]			
Beatley milkvetch[b]	*Astragalus beatleyae*	NL	CE
[Text deleted.]			
Mojave fishhook cactus[b]	*Sclerocactus polyancistrus*	NL	CY
[Text deleted.]			

[a] Status codes: C=Federal candidate; CE=critically endangered by authority of NRS 527.270 (State Division of Forestry); CY=protected by authority of NRS 522.60–.120 (Nevada Cacti and Yucca Law); E=endangered; NL=not listed; S/A=protected under the similarity of appearances provision of the ESA; T=threatened.

[b] Species recorded on NTS.

[c] Peregrine falcon seen on NTS; however not identified to subspecies level.

[d] USFWS Recovery Plan exists for this species.

[e] Species known to occur on the proposed new consolidated storage facility site.

[f] Only known location of this species is outside the NTS 48.3 km southwest of the proposed new consolidated storage facility site. This species is included here due to offsite groundwater concerns.

Note: Nevada Department of Wildlife is currently revising the state threatened and endangered species list.

Source: 50 CFR 17.11; 50 CFR 17.12; 61 FR 7596; DOE 1995w; NT DOE 1995j; NT DOE 1996c; NT DOI 1995a; NT ERDA 1976a; NV FWS 1989a; NV NHP 1995a.

The federally and State-listed peregrine falcon and bald eagle are considered rare migrants to NTS. The threatened desert tortoise is the only resident species known to inhabit NTS that is protected under ESA. The range of the desert tortoise lies in the southern third of the site (Figure 3.3.6–2). The abundance of tortoises on NTS is considered low to very low relative to other areas within this species' geographic range. Densities of tortoises on NTS range from 0 to 17 individuals per square kilometer (0 to 45 individuals per square mile), with most habitats probably having densities of 0 to 8 individuals per square kilometer (0 to 20 individuals per square mile) (NT DOE 1991b:3-23). The only known population of the Devils Hole pupfish lives in Devils Hole, a water-filled limestone cavern in Ash Meadows, approximately 48 km (29.8 mi) southwest of NTS. There is concern over the survival of the pupfish and other sensitive species found in the Ash Meadows area due to the threat of declining water levels (NT DOI 1991a:1,4-6; NT ERDA 1977a:2-134,2-135,4-28,4-29).

Table 3.3.6–1 identifies two State-protected plant species at NTS. [Text deleted.] The Federal-candidate mountain plover is a migrant species that has also been observed onsite. Although their distribution is unclear, the spotted bat has been recorded on NTS (Table 3.3.6–1).

The area within Frenchman Flat proposed for storage facilities (which is also the assumed analysis site for a number of disposition alternatives) is within the range of the desert tortoise. Both tortoise remains and scat have been observed in the proposed site area (NT EG&G 1991a:14,15,31). The alternate storage facility location (P-Tunnel project location) lies far north of the desert tortoise range. Occurrence of other special status species around the proposed project locations is unknown.

3.3.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

Prehistoric Resources. [Text deleted.] Prehistoric site types identified on NTS include habitation sites with wood and brush structures, windbreaks, rock rings, and cleared areas; rockshelters; petroglyphs (rock art); hunting blinds; rock alignments; quarries; temporary camps; milling stations; roasting ovens or pits; water caches; and limited activity locations. Milling stations are especially prevalent near the Yucca Lake playa margins. Several prehistoric rockshelters have been identified on Hogback Ridge. Approximately 6 percent of NTS has been inventoried for cultural resources. This includes all lands managed through a Memorandum of Agreement with Nellis Air Force Base. Excluding sites in the Yucca Mountain project area, approximately 1,600 prehistoric sites have been recorded. Hundreds of prehistoric sites have been identified in both Yucca Flat and Frenchman Flat; some of which may be eligible for listing on the NRHP. Additional prehistoric sites may occur in unsurveyed portions of NTS.

Historic Resources. Historic site types on NTS include mines and prospects, trash dumps, settlements, campsites, ranches, homesteads, developed spring heads, roads, trails, and nuclear weapons development sites. Historic resources associated with nuclear testing are common in both Yucca and Frenchman Flats. Nuclear test site structures and associated debris, including instrumentation stands and temporary storage bunkers, are also located within NTS. The test site area at Frenchman Flat, which includes the remains of many of these structures, has been recommended to the SHPO as a historic district. Excluding the Yucca Mountain project area, over 60 historic sites have been recorded. The only site currently listed on the NRHP is Sedan Crater. The crater was created in 1962 as part of the Plowshare Program, whose aim was to identify peaceful uses for nuclear explosions. It is located in Yucca Flat. The Emigrant Trail used by the "49ers" that traverses the southwestern corner of NTS is considered eligible for inclusion on the NRHP. Additional historic sites may occur in unsurveyed portions of NTS.

Native American Resources. The lands and resources of NTS have held an important place in the lives of Native Americans for centuries, and the area has been used continuously by many tribes. At the time of European-American contact, southern Nevada was inhabited by the Western Shoshone and the Southern Pahute. These peoples lived together in small groups from the spring through the fall. During winter, villages composed of several families were established in warmer places, close to preserves of pine nuts, seeds, and dried meats. Groups came to NTS from a broad region during the hunting season and relied on both animal and plant resources there that were crucial for their survival and cultural practices.

The NTS contains numerous ceremonial resources and power places that are critical for the continuation of Native American culture, religion, and society. Until the mid-1900s, traditional festivals involving religious and secular activities attracted Native American people to the area from as far as western California. There are numerous resources at NTS that are important to Native American groups. These resources include burials, ceremonial sites, musical stones, medicine rocks, petroglyphs, and traditional use areas. Local plants important in ritual and ceremonial activities include jimsonweed, juniper, greasewood, creosote, Indian tobacco, piñon pine, buckbush, and scrub oak. Concern has been expressed about the availability and accessibility of such resources.

Consultation with Native American cultural and religious leaders has been conducted for other projects at or near NTS to identify traditional cultural resources that may be affected by Federal actions and to obtain Native American recommendations for mitigating potential impacts on traditional cultural resources. DOE has established ongoing consultation with 17 Native American tribal organizations that have cultural ties to NTS. According to the American Indian Writers Subgroup of the Consolidated Group of Tribes and Organizations (CGTO), despite the loss of some traditional lands to pollution and reduced access, the Native American people have neither lost their ancestral ties to nor have forgotten their cultural resources on NTS. There is continuity in the Native American use of and broad cultural ties to NTS. Native American people continue to value and recognize the central role of these lands in their continued survival (NT DOE 1996c:4-162).

Paleontological Resources. The surface geology of NTS is characterized by alluvium-filled valleys surrounded by ranges composed of Precambrian and Paleozoic sedimentary rocks and Tertiary volcanic tuffs and lavas. The Precambrian and Paleozoic rocks at NTS represent relic deposits made in shallow water at the submerged edge of a continental platform that ran from Mexico to Alaska and existed throughout most of the Paleozoic. Although the Precambrian sedimentary deposits contain no fossils or only a few poorly preserved fossils, the Paleozoic marine limestones are moderately to abundantly fossiliferous. Marine fossils found in the same Paleozoic formations on Nellis Air Force Range, adjacent to NTS to the north, include trilobites, conodonts, ostracods, solitary and colonial corals, brachiopods, algae, gastropods, and archaic fish. These fossils, however, are relatively common and have low research potential.

Tertiary volcanic deposits are not expected to contain fossils; however, the Late Pleistocene terrestrial vertebrate fossils of the Rancholabrean Land Mammal Age could be expected in the Quaternary deposits. The possibility of finding mammoth, horse, camel, and bison remains might be expected because such fossils have been found at Tule Springs, 56 km (35 mi) from the southern edge of NTS, and in Nye Canyon. Fossils found at Tule Springs include bison, deer, a small donkey-like horse, camel, Columbia mammoth, ground sloth, giant jaguar, bobcat, coyote, muskrat, and a variety of rabbits, rodents, and birds. This paleontological assemblage has high research potential. Although no known fossil localities have been recorded to date, Quaternary deposits with paleontological materials may occur on NTS. Other Pleistocene resources include pack rat middens, which are studied by scientists at the University of Nevada, Reno, the Desert Research Institute, and the New Mexico Institute of Mines and Technology to investigate paleoclimatic regimes.